

WHAT IS CLAIMED IS:

1 1. A program development apparatus used for developing a
2 program to be installed in a system having at least a first central
3 processing and an other component, said program development
4 apparatus comprising:

5 a program generating section for generating said program and
6 an event pseudo-generating routine for pseudo-generating said
7 event based on a state-transition matrix and event pseudo-
8 generating information for pseudo-generating a same event as an
9 event which normally occurs based on data or a signal transmitted
10 from said other component to said first central processing unit
11 in said system, wherein said state-transition matrix has a
12 plurality of cells, each of said cells defined by a state in which
13 said system to be a subject of a program development is enabled
14 to be and an event which is an impulse from an outside or an inside
15 of said system and further wherein a content of a process to be
16 executed by said system and a state of a transition destination
17 to be transited when a corresponding event occurs under a
18 corresponding state are described in each said cell;

19 a second central processing unit having a same function as
20 said first central processing unit and for executing emulation
21 of said program and said event pseudo-generating routine; and

22 an analysis section for starting said emulation of said
23 program from a state input as an initial state and for referring
24 to said pseudo-generating information and rewriting information
25 for pseudo-generating said event memorized in a memory section
26 used in executing said event pseudo-generating routine into
27 information corresponding to said event which is instructed to
28 occur.

1 2. A program development apparatus used for developing a
2 program to be installed in a system having at least a first central
3 processing and an other component, said program development
4 apparatus comprising:

5 a state-transition matrix memory section for memorizing a
6 state-transition matrix, wherein said state-transition matrix
7 has a plurality of cells, each of said cells defined by a state
8 in which said system to be a subject of a program development is
9 enabled to be and an event which is an impulse from an outside
10 or an inside of said system and further wherein a content of a
11 process to be executed by said system and a state of a transition
12 destination to be transited when a corresponding event occurs
13 under a corresponding state are described in each said cell;

14 an event pseudo-generating editor for generating event
15 pseudo-generating information for pseudo-generating a same event
16 as an event which normally occurs based on data or a signal
17 transmitted from said other component to a first central
18 processing unit in said system;

19 a program generating section for generating said program and
20 an event pseudo-generating routine for pseudo-generating said
21 event;

22 a second central processing unit for having a same function
23 as said first central processing unit and for executing emulation
24 of said program and said event pseudo-generating routine;

25 an input section for detecting which display position of each
26 event or each state is indicated among a plurality of events and
27 a plurality of states forming said state-transition matrix
28 displayed on a display section and for outputting position
29 information of said display position; and

30 an analysis section for converting said position information

31 into an event code or a state code corresponding to said position
32 so as to set a state corresponding to said state code as an initial
33 state for starting emulation of said program and for referring
34 to said pseudo-generating information so as to rewrite
35 information memorized in a memory section used in executing said
36 pseudo-generating routine, said information for pseudo-
37 generating an event into information corresponding to said event
38 code.

1 3. A program development apparatus used for developing a
2 program to be installed in a system having at least a first central
3 processing and an other component, said program development
4 apparatus comprising:

5 a state-transition matrix memory section for memorizing a
6 state-transition matrix, wherein said state-transition matrix
7 has a plurality of cells, each of said cells defined by a state
8 in which said system to be a subject of a program development is
9 enabled to be and an event which is an impulse from an outside
10 or an inside of said system and further wherein a content of a
11 process to be executed by said system and a state of a transition
12 destination to be transited when a corresponding event occurs
13 under a corresponding state are described in each said cell;

14 an event pseudo-generating editor for generating event
15 pseudo-generating information for pseudo-generating a same event
16 as an event which normally occurs based on data or a signal
17 transmitted from said other component to a first central
18 processing unit in said system;

19 a program generating section for generating said program and
20 an event pseudo-generating routine for pseudo-generating said
21 event;

22 a second central processing unit for having a same function
23 as said first central processing unit and for executing emulation
24 of said program and said event pseudo-generating routine;
25 an input section for detecting which display position of each
26 event or each state is indicated among a plurality of events and
27 a plurality of states forming said state-transition matrix
28 displayed on a display section so as to output position
29 information of said display position and for generating an input
30 event log including an order of instructed events and an
31 instruction timing of each event; and
32 a script generating section for generating a script file in
33 which an occurrence timing of each event and a timing at which
34 an element in said system operates in accordance with a
35 specification are described based on said input event log;
36 a script analysis section for sequentially outputting
37 position information of each event described in said script file
38 and of a corresponding display area in said state-transition
39 matrix displayed on said display section in order and at an
40 occurrence timing described in said script file; and
41 an analysis section for converting said position information
42 into an event code or a state code corresponding to said position
43 so as to set a state corresponding to said state code as an initial
44 state for starting emulation of said program and for referring
45 to said pseudo-generating information so as to rewrite
46 information memorized in a memory section used in executing said
47 pseudo- generating routine, said information for pseudo-
48 generating an event into information corresponding to said event
49 code.

1 4. The program development apparatus according to Claim 3

2 further comprising:

3 a script editor for editing said script file based on any
4 one of an event input to be occurred, an occurrence timing of said
5 event and an occurrence frequency.

1 5. The program development apparatus according to Claim 3,
2 wherein said script file is any one of a timing chart format, a
3 text format and a message sequence chart format.

1 6. The program development apparatus according to Claim 1,
2 wherein said program includes a main routine for executing a main
3 process of said system and a normal generating event routine for
4 normally generating a corresponding event based on various data
5 and a signal transmitted from said other component to said first
6 central processing unit.

1 7. The program development apparatus according to Claim 2,
2 wherein said program includes a main routine for executing a main
3 process of said system and a normal generating event routine for
4 normally generating a corresponding event based on various data
5 and a signal transmitted from said other component to said first
6 central processing unit.

1 8. The program development apparatus according to Claim
2 3, wherein said program includes a main routine for executing
3 a main process of said system and a normal generating event routine
4 for normally generating a corresponding event based on various
5 data and a signal transmitted from said other component to said
6 first central processing unit.

1 9. The program development apparatus according to Claim 1,
2 wherein said event pseudo-generating information is information
3 of a generating technique in accordance with said event.

1 10. The program development apparatus according to Claim
2, wherein said event pseudo-generating information is
3 information of a generating technique in accordance with said
4 event.

1 11. The program development apparatus according to Claim
2, wherein said event pseudo-generating information is
3 information of a generating technique in accordance with said
4 event.

1 12. The program development apparatus according to Claim
2, wherein said event is any one of a message-type for receiving
3 a start message from another task or another apparatus, a
4 flag-type for reading a variation of a variable or an input/output,
5 an interrupt-type for receiving an interrupt from an outside, an
6 in-mail type for notifying an internal event which occurs in a
7 cell of said state-transition matrix to another state-transition
8 matrix when said state-transition matrix is layered and a
9 function-call type for calling a function executing a group of
10 processes.

1 13. The program development apparatus according to Claim
2, wherein said event is any one of a message-type for receiving
3 a start message from another task or another apparatus, a
4 flag-type for reading a variation of a variable or an input/output,
5 an interrupt-type for receiving an interrupt from an outside, an

8 matrix when said state-transition matrix is layered and a
9 function-call type for calling a function executing a group of
10 processes.

1 14. The program development apparatus according to Claim
2 3, wherein said event is any one of a message-type for receiving
3 a start message from another task or another apparatus, a
4 flag-type for reading a variation of a variable or an input/output,
5 an interrupt-type for receiving an interrupt from an outside, an
6 in-mail type for notifying an internal event which occurs in a
7 cell of said state-transition matrix to another state-transition
8 matrix when said state-transition matrix is layered and a
9 function-call type for calling a function executing a group of
10 processes.

1 15. A program development method used for developing a
2 program to be installed in a system having at least a first central
3 processing and an other component, said program development
4 method comprising:

5 a first step of generating said program and an event
6 pseudo-generating routine for pseudo-generating said event based
7 on a state-transition matrix and event pseudo -generating
8 information for pseudo-generating a same event as an event which
9 normally occurs based on data or a signal transmitted from said
10 other component to said first central processing unit in said
11 system, wherein said state-transition matrix has a plurality of
12 cells, each of said cells defined by a state in which said system
13 to be a subject of a program development is enabled to be and an
14 event which is an impulse from an outside or an inside of said
15 system and further wherein a content of a process to be executed

16 by said system and a state of a transition destination to be
17 transited when a corresponding event occurs under a corresponding
18 state are described in each said cell; and

19 a second step of starting emulation of said program from a
20 state input as an initial state, of referring to said pseudo-
21 generating information while executing said event pseudo-
22 generating routine and of rewriting information for pseudo-
23 generating said event memorized in a memory section used in
24 executing said event pseudo-generating routine into information
25 corresponding to said event which is instructed to occur.

1 16. A program development method used for developing a
2 program to be installed in a system having at least a first central
3 processing and an other component, and carried out by using:

4 a state-transition matrix memory section for memorizing a
5 state-transition matrix, wherein said state-transition matrix
6 has a plurality of cells, each of said cells defined by a state
7 in which said system to be a subject of a program development is
8 enabled to be and an event which is an impulse from an outside
9 or an inside of said system and further wherein a content of a
10 process to be executed by said system and a state of a transition
11 destination to be transited when a corresponding event occurs
12 under a corresponding state are described in each said cell;

13 an input section for detecting a display position of which
14 event or state is instructed among a plurality of events or a
15 plurality of states forming said state-transition matrix
16 displayed on a display section and for outputting position
17 information about detected said display position, said program
18 development method comprising:

19 a first step of generating event pseudo-generating

20 information for pseudo-generating a same event as an event
21 normally generated based on data or a signal transmitted from said
22 other component to a first central processing unit in said system;

23 a second step of generating said program and an event
24 pseudo-generating routine for pseudo-generating said event based
25 on said state-transition matrix and said event pseudo-generating
26 information; and

27 a third step of converting said position information into
28 an event code or a state code corresponding to said position, of
29 starting emulation of said program from a state input as an initial
30 state, of referring to said pseudo-generating information while
31 executing said event pseudo-generating routine and of rewriting
32 information for pseudo-generating said event memorized in a
33 memory section used in executing said event pseudo-generating
34 routine into information corresponding to said event which is
35 instructed to occur.

1 17. A program development method used for developing a
2 program to be installed in a system having at least a first central
3 processing and an other component, and carried out by using:

4 a state-transition matrix memory section for memorizing a
5 state-transition matrix, wherein said state-transition matrix
6 has a plurality of cells, each of said cells defined by a state
7 in which said system to be a subject of a program development is
8 enabled to be and an event which is an impulse from an outside
9 or an inside of said system and further wherein a content of a
10 process to be executed by said system and a state of a transition
11 destination to be transited when a corresponding event occurs
12 under a corresponding state are described in each said cell;
13 an input section for detecting a display position of which

14 event or state is instructed among a plurality of events or a
15 plurality of states forming said state-transition matrix
16 displayed on a display section and for outputting position
17 information about detected said display position, said program
18 development method comprising:

19 a first step of generating event pseudo-generating
20 information for pseudo-generating a same event as an event
21 normally generated based on data or a signal transmitted from said
22 other component to a first central processing unit in said system;

23 a second step of generating said program and an event
24 pseudo-generating routine for pseudo-generating said event based
25 on said state-transition matrix and said event pseudo-generating
26 information;

27 a third step of generating an input event log including an
28 order of instructed events and a timing at which each event is
29 instructed;

30 a fourth step, based on said input event log, of generating
31 a script file in which an occurrence timing of each event described
32 in said state-transition matrix and a timing at which an element
33 in said system operates in accordance with a specification are
34 described;

35 a fifth step of sequentially outputting position information
36 of each event described in said script file and of a corresponding
37 display area in said state-transition matrix displayed on said
38 display section in order and at an occurrence timing described
39 in said script file; and

40 a sixth step of converting said position information into
41 an event code corresponding to said position, of referring to said
42 event pseudo-generating information while executing said event
43 pseudo-generating routine and of rewriting information memorized

44 in a memory section used by said event pseudo-generating routine,
45 said information for pseudo-generating an event into information
46 corresponding to said event code.

1 18. The program development method according to Claim 17,
2 further comprising:

3 a seventh step of editing said script file based on any one
4 of an event input to be occurred, an occurrence timing of said
5 event and an occurrence frequency.

1 19. The program development method according to Claim 17,
2 wherein said script file is any one of a timing chart format, a
3 text format and a message sequence chart format.

1 20. The program development method according to Claim 15
2 wherein said program includes a main routine for executing a main
3 process of said system and a normal generating event routine for
4 normally generating a corresponding event based on various data
5 and a signal transmitted from said other component to said first
6 central processing unit.

1 21. The program development method according to Claim 16
2 wherein said program includes a main routine for executing a main
3 process of said system and a normal generating event routine for
4 normally generating a corresponding event based on various data
5 and a signal transmitted from said other component to said first
6 central processing unit.

1 22. The program development method according to Claim 17
2 wherein said program includes a main routine for executing a main

3 process of said system and a normal generating event routine for
4 normally generating a corresponding event based on various data
5 and a signal transmitted from said other component to said first
6 central processing unit.

1 23. The program development method according to Claim 15,
2 wherein said event pseudo-generating information is information
3 of a generating technique in accordance with said event.

1 24. The program development method according to Claim 16,
2 wherein said event pseudo-generating information is information
3 of a generating technique in accordance with said event.

1 25. The program development method according to Claim 17,
2 wherein said event pseudo-generating information is information
3 of a generating technique in accordance with said event.

1 26. The program development method according to Claim 15,
2 wherein said event is any one of a message-type for receiving a
3 start message from another task or another apparatus, a flag-
4 type for reading a variation of a variable or an input/output,
5 an interrupt-type for receiving an interrupt from an outside, an
6 in-mail type for notifying an internal event which occurs in a
7 cell of said state-transition matrix to another state-transition
8 matrix when said state-transition matrix is layered and a
9 function-call type for calling a function executing a group of
10 processes.

1 27. The program development method according to Claim 16,
2 wherein said event is any one of a message-type for receiving a

3 start message from another task or another apparatus, a flag-
4 type for reading a variation of a variable or an input/output,
5 an interrupt-type for receiving an interrupt from an outside, an
6 in-mail type for notifying an internal event which occurs in a
7 cell of said state-transition matrix to another state-transition
8 matrix when said state-transition matrix is layered and a
9 function-call type for calling a function executing a group of
10 processes.

1 28. The program development method according to Claim 17,
2 wherein said event is any one of a message-type for receiving a
3 start message from another task or another apparatus, a flag-
4 type for reading a variation of a variable or an input/output,
5 an interrupt-type for receiving an interrupt from an outside, an
6 in-mail type for notifying an internal event which occurs in a
7 cell of said state-transition matrix to another state-transition
8 matrix when said state-transition matrix is layered and a
9 function-call type for calling a function executing a group of
10 processes.

1 29. A program development program for causing a computer
2 to carry out a program development method used for developing a
3 program to be installed in a system having at least a first central
4 processing and an other component, said program development
5 method comprising:

6 a first step of generating said program and an event
7 pseudo-generating routine for pseudo-generating said event based
8 on a state-transition matrix and event pseudo -generating
9 information for pseudo-generating a same event as an event which
10 normally occurs based on data or a signal transmitted from said

11 other component to said first central processing unit in said
12 system, wherein said state-transition matrix has a plurality of
13 cells, each of said cells defined by a state in which said system
14 to be a subject of a program development is enabled to be and an
15 event which is an impulse from an outside or an inside of said
16 system and further wherein a content of a process to be executed
17 by said system and a state of a transition destination to be
18 transited when a corresponding event occurs under a corresponding
19 state are described in each said cell; and

20 a second step of starting emulation of said program from a
21 state input as an initial state, of referring to said pseudo-
22 generating information while executing said event pseudo-
23 generating routine and of rewriting information for pseudo-
24 generating said event memorized in a memory section used in
25 executing said event pseudo-generating routine into information
26 corresponding to said event which is instructed to occur.

1 30. A storage medium storing a program development program
2 for causing a computer to carry out a program development method
3 used for developing a program to be installed in a system having
4 at least a first central processing and an other component, said
5 program development method comprising:

6 a first step of generating said program and an event
7 pseudo-generating routine for pseudo-generating said event based
8 on a state-transition matrix and event pseudo -generating
9 information for pseudo-generating a same event as an event which
10 normally occurs based on data or a signal transmitted from said
11 other component to said first central processing unit in said
12 system, wherein said state-transition matrix has a plurality of
13 cells, each of said cells defined by a state in which said system

14 to be a subject of a program development is enabled to be and an
15 event which is an impulse from an outside or an inside of said
16 system and further wherein a content of a process to be executed
17 by said system and a state of a transition destination to be
18 transited when a corresponding event occurs under a corresponding
19 state are described in each said cell; and

20 a second step of starting emulation of said program from a
21 state input as an initial state, of referring to said pseudo-
22 generating information while executing said event pseudo-
23 generating routine and of rewriting information for pseudo-
24 generating said event memorized in a memory section used in
25 executing said event pseudo-generating routine into information
26 corresponding to said event which is instructed to occur.

1 31. A program development program for causing a computer
2 to carry out a program development program for causing a computer
3 to carry out A program development method used for developing a
4 program to be installed in a system having at least a first central
5 processing and an other component, said program development
6 method comprising:

7 a state-transition matrix memory section for memorizing a
8 state-transition matrix, wherein said state-transition matrix
9 has a plurality of cells, each of said cells defined by a state
10 in which said system to be a subject of a program development is
11 enabled to be and an event which is an impulse from an outside
12 or an inside of said system and further wherein a content of a
13 process to be executed by said system and a state of a transition
14 destination to be transited when a corresponding event occurs
15 under a corresponding state are described in each said cell;
16 an input section for detecting a display position of which

17 event or state is instructed among a plurality of events or a
18 plurality of states forming said state-transition matrix
19 displayed on a display section and for outputting position
20 information about detected said display position;

21 a first step of generating event pseudo-generating
22 information for pseudo-generating a same event as an event
23 normally generated based on data or a signal transmitted from said
24 other component to a first central processing unit in said system;

25 a second step of generating said program and an event
26 pseudo-generating routine for pseudo-generating said event based
27 on said state-transition matrix and said event pseudo-generating
28 information; and

29 a third step of converting said position information into
30 an event code or a state code corresponding to said position, of
31 starting emulation of said program from a state input as an initial
32 state, of referring to said pseudo-generating information while
33 executing said event pseudo-generating routine and of rewriting
34 information for pseudo-generating said event memorized in a
35 memory section used in executing said event pseudo-generating
36 routine into information corresponding to said event which is
37 instructed to occur.